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## MUTATIONS AND THE EVOLUTION OF MAN.

By ALTON H. THOMPSON, Topeka.

THE discovery and demonstration of the principle of mutations in the formation of species and varieties of plants, by Hugo De Vries, is one of the most brilliant achievements in the history of evolution since the publication of Darwin's "Origin of Species." Its recent promulgation has thrown a flood of light upon many puzzling and obscure questions, and has aided materially in the solution of some intricate problems in the science of biology. Of course, there is danger of carrying it too far in its application, like all revolutionary discoveries, for after all it only supplements natural selection and assists in solving problems that that great principle could not account for. It is a source of wonder to later scientists that Darwin, with all his observations and great insight into the workings of nature, should have failed to perceive the idea of sudden mutations, and held it as an inviolable principle that all changes of structure were due to very gradual alterations, the result of natural selection.

Darwin succinctly states his doctrine in a letter to Haeckel, as follows: "Having reflected much on the facts, it seems to me probable that allied species were descended from a common ancestor. But during several years I could not conceive how each form could have been modified so as to become so admirably adapted to its place in nature. I began, therefore, to study domesticated animals and plants, and after a time perceived that man's power of selecting and breeding from certain individuals was the most powerful of all means in the production of new races. Having attended to the habits of animals and their relations to surrounding conditions, I was able to realize the severe struggle for existence to which all organisms are subjected; and my geological observations had allowed me to appreciate the duration of past geological periods. With my mind thus prepared, I fortunately happened upon Malthus's 'Essay on Population,' and the idea of natural selection through the struggle for existence at once occurred to me."

So it remained for the astute mind of De Vries to perceive that sudden changes of structure were possible, and under certain conditions could be made permanent. The general acceptance and the revolutionary effect of the idea of the origin of species by mutations has been marvelous, and is second only to the revolutionary

wave that swept over the world of thought following the publication of the "Origin of Species."

Hugo De Vries says of the previous condition of the science of origins (in speaking of Burbank's work) that, "Of great scientific importance is the question whether repeated selections are sufficient to bring about new forms, and, further, if by this means more variations are produced. We have no facts to indicate this, but it has great importance in the study of conditions. It is closely connected with the question whether species slowly merge into one another or whether they originate by mutations. In the former case small deviations would increase in the course of generations; and thus a long series of intermediate forms would connect man and all other species. In the latter case of mutations a jump is made without any intermediate stages."

The doctrine of mutations is founded upon seven laws, which De Vries thus states: "(1) New elementary species appear suddenly, without intermediate steps; (2) they spring latterly from the main stem, not affecting it; (3) they attain their full constancy at once; (4) some of the new strains are elementary species, others are to be regarded as varieties; (5) the same new species are produced in a large number of individuals; (6) mutations undergo fluctuating variation, but the latter is not evolution; and (7) mutations take place in nearly all directions."

Like Darwin, his great discovery was founded on experimentation, elaborate and long continued, and he worked upon well-known and familiar facts. Stock-breeders and horticulturists have long employed the method of making permanent the sudden changes that produce variations, but no one before ever attempted to formulate the facts of mutation into a law and to conduct investigations upon such a basis.

Prof. Chas. A. White thus well summarizes the subject in *Science*: "Species originate from other species through the ordinary function of reproduction, but they each originate suddenly and completely by one mutative act, and not by the slow accumulative variations of individuals. The beginning of the mutative process which is due to some unknown natural determinative cause, some molecular change in the germ-cell of the fertilized ovum, whereby the new individual acquires changed structural characters. The new species thus produced by mutation is in immediate possession of clearly distinguishing and hereditarily transmissible characters, and it has no more tendency to hybridize with any other member of the mother species than have other species. Strains

thus produced are called elementary species, and differ distinctly but not widely from the mother species."

It is well known that geologists have long been dissatisfied with the theory of natural selection by the accumulation of slow progressive changes as the one method of the origin of species.

Professor White again says: "There has been an increasing distrust of the theory of natural selection for the origin of species that Darwin proposed a half-century ago, and it has been especially felt in endeavoring to apply it to certain lines of paleontological investigation. It has been regarded with growing disfavor in such cases, as it is shown that genera, families, orders and classes of animal and plants have, during geological time, usually originated with such comparative rapidity as to make it necessary to infer that species have originated suddenly; that the ratio of progressive development has not only not been uniform, but has been exceedingly diverse; that environment had little to do with the origin or destruction of species. These and other items made it necessary to presuppose some other theory for the sudden origin of species to harmonize them with the past conditions which they reveal. After the fishes and reptiles, a sudden change marks the introduction of the placental mammals which occurred about the beginning of Tertiary time. These highly organized animals assumed faunal dominion of the earth which the decadent dinosaurs had just departed from. They came in great diversity of forms, and their organization was little if any inferior to that of the mammals now living of lower grade than the Quadrumana. There has been found no evidence of evolution from earlier forms by any slow process, and they became extinct at or before the close of the Eocene epoch. They were succeeded by the Miocene and Pliocene mammalia, exhibiting many strange and suddenly introduced forms. Indeed, the history of the mammalia from the earliest Tertiary to the present time embraces a record of rapid and varied evolution of the highest grades of animals, culminating in man. If it should ever be possible to trace the evolution of man from the lower animals, it will probably be found that it has been accomplished, not by the slow process of natural selection, but by a series of sudden mutations."

Indeed, the theory accounts for much in the evolutionary history of man that has been lacking. In the first place, his geological history is quite insufficient to allow of his gradual development, according to the theory of natural selection, by slow accretions of alterations. The earliest form of lemur, *Anaptomorphus*, which was probably the ancestor of all of the Anthropoidæ, is too recent

to allow time enough, geologically, for the slow evolution of man from this stock. We have reason to believe that the psychic emergence of man from lower forms was a sudden mutation, and from the start his mental evolution took place by leaps and bounds. All of his physical alterations and his special brain and mental development indicate such a process of sudden mutations. To be sure, the gap between man and the highest anthropoids has been materially lessened by the discovery of *Pitheconthropus* and the studies of the pygmies, but there are still many missing links which were necessary according to the theory of natural selection. With the principle of mutations, however, we can dispense with these links in the formerly supposed necessary chain, and observe how perfectly the wonderful theory of mutations can account for perhaps all of the marvelous changes that have taken place in the evolution of man.

The theory of mutations will alone account for the psychic emergence in relation to its necessary suddenness and the successive rapid changes that took place in the growth of the brain in response to higher mental activity and the correlative changes in physical structure. The theory of selective influences and the slow accretion of alterations has never been satisfactory, and has bitter opponents. The early geological horizons in which stone implements of supposedly human manufacture have been found, the authenticity of which has never been satisfactory, need not trouble the anthropologist now, for it is possible that man could have emerged as suddenly as many other animals which the geological history of the earth has demonstrated. The problem of man's origin is now in a fair way of being solved and fills us with excited expectation. We can accept with confidence now the evidence of his existence in early geological formations, which we have felt heretofore that we must reject as impossible. The geological evidences of the earliest occurrence of man, are now trustworthy, and we can accept them without the reluctance with which we have heretofore regarded them. We can now believe in the possibility of Pliocene man, and the disputed questions of the probability of early Pleistocene man are at once settled. All the implements of early man can now be accepted as genuine, and perhaps a flint chip from the Miocene even, which we have held as being impossible of human workmanship, we may now regard as possible.

Not only does early geological man thus become a certainty through the theory of mutations, but it will also throw much light upon later and other anthropological problems; for instance, the

question of the origin of races, which has always been a most difficult one. That the great variations of mankind could have arisen merely through the influence of environment, climate, food, terrestrial or cosmic influences, which were tentatively offered, owing to the theory of slow changes, we have been long convinced are not sufficient. We now feel satisfied that the great racial variations originated suddenly, by mutations, and that from "sports," so to speak, the races had their origin. The mutation theory throws a flood of light upon this great question, but which awaits the working out of the details.

The theory accounts also for the origin of very early civilizations, which we have heretofore believed must have had a slow growth by natural development. We can now realize how a superior race could spring into prominence, and, by unusual ability, rapidly evolve a high civilization; as witness the ancient Assyrians, Egyptians, Greeks, Romans, Peruvians, Mexicans, and others. History tells us that the rise and development of such peoples were very rapid, and that a very few centuries were required for them to progress from savagery to high civilization, and which we now know must have been due to mutations—to the sudden appearance of superior intellects without a previous gradual development. Modern nations also have arisen into intellectual prominence and accomplishments by leaps and bounds, as many examples that occur at once to every one will amply prove. At the present time we need some moral mutations to correct the aberrations of conscience of men in high places.

Indeed, the idea opens up an illimitable field for speculation. As a recent writer in *Science* well said: "Born in the womb of lower animals, man has become the most wonderful living thing on earth, although separated now by a great gulf from his next of kin. Inexperienced in his early history, his mind steadily advanced, until to-day he contemplates all nature with a yearning to know its mysteries. The changes in the germ-cell sufficing to evolve him are as inscrutable to his reason as the constitution of matter or the interstellar space ether, or the origin, nature and the meaning of life itself. But we ardently desire to know these things—to peer out into unfathomable space and to speculate upon the meaning of our existence and the unknowable as we perceive it all about us in the universe. But as a species, *sapiens*, of the genus *Homo*, we can never know. We seem to be but intellectual atoms floating in an infinity of space and time."